(12) UK Patent Application (19) GB (11) 2 317 203 (13) A

(43) Date of A Publication 18.03.1998

(21) Application No 9619208.3

(22) Date of Filing 13.09.1996

(51) INT CL[6]
F01M 13/00 11/03

(52) UK CL (Edition P)
F1B B5Q3G

(56) Documents Cited
None

(58) Field of Search
UK CL (Edition O) F1B
INT CL[6] F01M 11/03 13/00 13/02 13/04
Online: WPI

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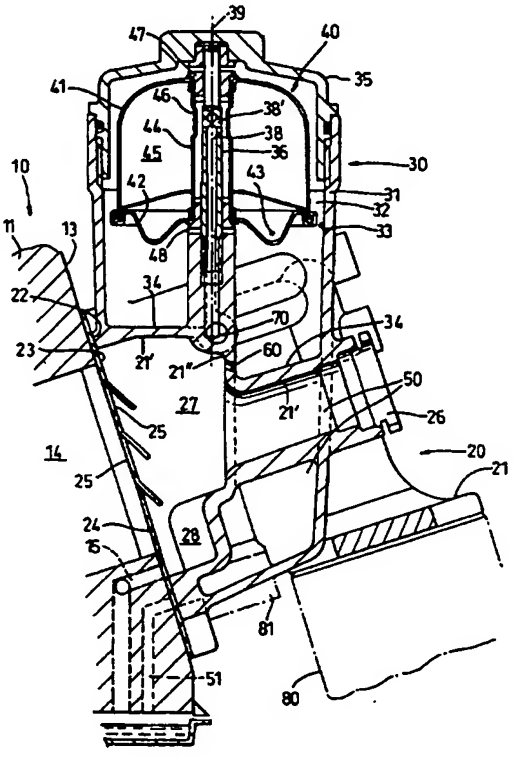
(54) I.c. engine crankcase breather assembly incorporating a centrifugal oil cleaner

(57) A crankcase breather assembly (20), for an internal combustion engine (10) having crankcase (11) and prepared face (13) to which the breather assembly is secured with aligned ducts, has a cast body 21 through which crankcase air flows for combustion and from which droplets of oil are separated by louvred gasket (23) or components in the chamber, such separated oil being returned to the crankcase. The body (21) also forms the floor (34) and side walls (33) for a centrifugal filter housing (31) and supports axle (36) upon which spins a rotor canister (40). Oil supplied along the axle exits the canister and flows from the floor by gravity in drainage duct (50) surrounding the breather outlet and re-enters the crankcase. To prevent poor drainage by way of pressure variations in the centrifugal enclosure caused by frothing of the oil, a vent 60 is conveniently formed between the enclosure and separation chamber through dividing wall 21 " of the body casting.



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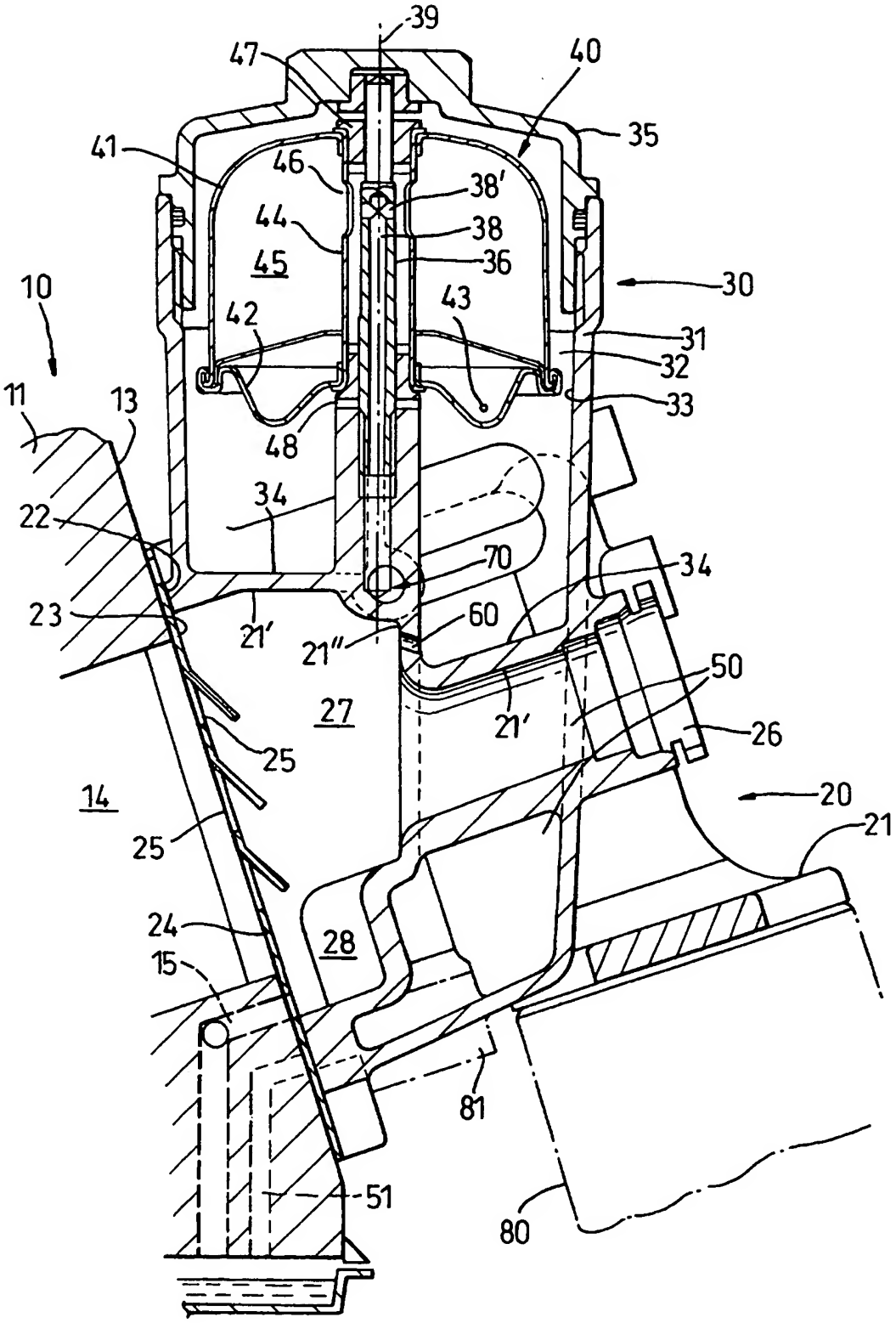
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.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I C Engine Crankcase Breather Assembly

This invention relates to crankcase breather assemblies for internal combustion engines and in particular relates to increasing the functionality of such breather assemblies in order to utilise scarce interfacing sites between an engine crankcase and externally mounted devices.

Modern internal combustion engines fitted to motor vehicles have to comply with consumer-led requirements for greater reliability and reduced maintenance as well as legislation - led requirements for less polluting operation. One pollution reducing measure comprises preventing the atmosphere within the engine crankcase from venting to the environment and to this end it is known to prepare a face on the engine crankcase, having ports leading to the lubricating oil sump and to the crankcase atmosphere above the sump, and to mount a crankcase breather assembly onto the prepared face whereby such contaminated crankcase atmosphere is drawn into the engine for combustion, such assembly having an air duct through the assembly and leading to a combustion air-intake of the engine, and an intervening separation chamber in which droplets of oil in the entrained atmosphere are separated for return to the crankcase sump by way of a breather drainage duct and said prepared face.

In respect of other requirements, it is becoming more popular to increase servicing intervals by improved filtration of the lubricating oil that is pumped around th engine, replacing the normal fine-pore full flow filter element with a coarser mesh and

supplementing such full flow filing by a centrifugal separator which, operating in a by-pass mode, uses a proportion of the circulated oil to spin a centrifugal separation rotor in which solid contaminants are separated from the oil before the spent oil is returned to the engine sump.

Clearly such additional centrifugal cleaning device requires fluid communication with the engine crankcase, but this is often difficult to arrange, and is particularly difficult to facilitate on existing crankcase designs where provision does not exist for attachment, such devices then being mounted not only remotely of the engine but served also by exposed, and vulnerable, hoses and pipes for the oil supplied at elevated pressure and drained by gravity.

Because such oil (having expended its energy by spinning the rotor) has in general to drain to the sump by gravity there is the need to provide an additional drainage path of such dimensions and route that the oil can drain properly. Also, a situation is known to occur with such centrifugal cleaning devices in which air pressure within the housing enclosing the spinning rotor affects the ability to drain efficiently. Such situation is normally dealt with by the conceptually simple provision of a large cross-section draining duct, which can both drain liquid and permit air flow to and from the enclosure, or a vent in the enclosure housing to the environment.

However, the environmental considerations may preclude such venting to the atmosphere and space and cost considerations may, as already mentioned, preclude the provision of a sufficiently large drainage duct.

It is an object of the present invention to provide an engine crankcase breather assembly which also facilitates improved oil filtering for the engine.

According to th present invention an engine crankcase breather assembly includes a body having a mounting surface arranged to

be mounted to a prepared face of a crankcase of an engine with which used, said body including an atmosphere inlet duct in said mounting surface arranged to be in communication with the atmosphere above an oil sump of the crankcase, an atmosphere outlet duct arranged to be connected to a combustion air intake of the engine and therewith to draw the crankcase atmosphere through the housing, a separation chamber between said atmospheric inlet and outlet ducts arranged to separate oil droplets from said atmosphere within the housing, a breather drainage duct arranged to receive oil separated in said chamber and opening in said mounting surface arranged to be in communication with a corresponding duct in the crankcase in communication with said oil sump, and integrally with the assembly a centrifugal cleaner for oil circulated within the engine from said crankcase sump.

Preferably the body defines an engine crankcase breather assembly in which said body defines wall and floor regions of an enclosure for a self-powered centrifugal separation rotor of the centrifugal cleaner and a centrifuge drainage duct, extending through the body from said floor region to the chamber drainage duct.

The assembly as defined in the preceding paragraph may include a vent passage extending through the body between the breather chamber and said centrifugal cleaner enclosure region wall and floor regions.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawing, in which the single Figure shows in sectional elevation an engine crankcase breather assembly and integral centrifugal cleaner.

Referring to the Figure, a vehicle engine 10 having a crankcase 11, the floor of which forms a lubricating oil sump 12, also includes a pump (not shown) for circulating the oil to b aring and like components at elevated pressure. Th crankcase 11 includes a prepared face 13 arranged to receive, and have mounted

thereon, an engine crankcase br ather assembly indicated generally at 20. The prepar d face 13 includes a port 14 which communicates with the atmosphere inside the crankcase above the sump and a port 15 which communicates with the sum to permit oil to drain thereto.

The crankcase breather assembly 20 comprises a body 21 formed as a metal casting and having a mounting surface 22 arranged to be mounted against the prepared face 13 of the crankcase and the ports 14 and 15 therein by way of a gasket 23. The body 21 contains an atmosphere inlet duct 23 in the mounting surface 22, arranged to communicate with the crankcase atmosphere by mounted alignment with port 14 and louvre apertures 25 in the gasket 23, and an atmosphere outlet duct 26 operably connected to an engine combustion air intake or the like (not shown) whereby air comprising the crankcase atmosphere is drawn through the assembly in certain circumstances. Between the atmosphere inlet and outlet ducts the body contains a separation chamber 27. The separation chamber may contain a baffle or swirl structure to encourage separation of oil droplets, such arrangements being well known in the art and requiring no further description, although for most uses the louvred gasket achieves adequate separation. A breather drainage duct 28 extends through the body from the separation chamber to the mounting surface, arranged to align with the crankcase port 15 leading to the sump so that oil droplets in the separation chamber separated from the atmosphere can drain by gravity to the sump.

The crankcase breather assembly 20 as described to this point is essentially conventional. In accordance with the present invention, its functionality is increased by forming integrally with the assembly a centrifugal cleaner, indicated generally at 30, for the oil that is circulated within the engine from the crankcase sump.

Such a self-powered centrifugal separator is of a form generally known, for example from Patent specifications GB 735658 differing in respect of features of structural detail in accordance with

the invention.

In brief terms, the centrifugal separator comprises a housing, indicated at 31 which defines an enclosure 32. The housing is defined by integrally formed side wall and floor regions 33 and 34 respectively, the upper edge of the side wall being adapted (by peripheral screw threading) to engage a cover member 35 which closes the housing and defines the enclosure. An elongate axle member 36 extends through the enclosure between the floor and the cover member, being fixed to an upstanding and ducted pedestal portion 37 of the floor and containing a longitudinally extending passage 38 that includes a transverse aperture 38'. The longitudinal axis 39 of the axle coincides with that of the housing and also forms a rotation axis for a centrifugal separation rotor 40 mounted on the axle.

The centrifugal separation rotor 40 is in the form of an essentially cylindrical annular canister having an integral sidewall and top portion 41 and base portion 42 containing an array of jet reaction nozzles, only one of which is shown at 43. The portions 41 and 42 surround a tubular member 44 which extends for the length of the rotor and defines an annular enclosure 45 within the rotor, the tubular member 44 being apertured at 46 to receive liquid from the axle aperture 39 and further carrying at opposite ends thereof bearing bushes 47 and 48 by way of which the rotor is able to undertake high speed rotation about the axle.

The jet reaction nozzles 43 et al in the base of the rotor are directed substantially tangentially with respect to the longitudinal axis 38 and possibly slightly declined towards the floor of the housing.

Operation of the centrifugal separator per se is essentially conventional; engine lubricating oil, supplied to the axle passage at the elevated pressure at which it is pumped around the engine, enters the rotor 40 by way of the tubular member 44 and, when pressure is establish d therein, is forced from the rotor

by way f the jet reaction nozzles and into the enclosure 32 of housing 31 from the flo r of which it drains by gravity. The pressure drop across the reaction nozzles by the ejected oil translates into rotation of the rotor as a reaction to the ejection and which rotation, if sufficiently rapid, causes particulates to be separated from the oil within the rotor enclosure and agglomerate against the wall 41 thereof. It will be seen as fundamental to efficient spinning of the rotor that the ejected, spent oil drains from the housing without accumulating therein and rising to contact the rotor, which would stall.

As mentioned above, the combination of high speed jets, splashing and collection of the oil and low speed gravitational drainage of the oil gives rise to variations of the duct atmospheric pressure within the housing enclosure that requires, for efficient drainage, some means of regulating the housing atmosphere with respect to that of the engine crankcase or the environment.

In the breather assembly 20, the body 21 defines integrally with the body casting the wall and floor regions 33, 34 respectively of the centrifugal separator housing as well as a centrifuge drainage duct 50 which extends through the body from the floor region to the chamber drainage duct 26', from whence it terminates at the mounting surface 22 in operative alignment with a crankcase port 51 leading to the sump.

Conveniently, and in a compact manner, the reduction in cross-section between the breather chamber and the atmosphere outlet duct 26 accommodates, by a simple separating web 21' of the body casting a stepped floor region of the centrifugal separator housing which leads towards the drainage duct 50 extending from the operationally lowest part thereof.

The breather assembly also includes a vent passage 60 extending through the body 21 between the breather separation chamber 25 and the centrifugal cleaner housing enclosure 32 as defined by

wall and floor regions 33 and 34. Conveniently the v nt passage extends through the body casting web 21′ in a riser 21′′ of the stepped floor region.

It will be appreciated that the supply of high pressure oil to the axle member 36 requires a supply duct 70 extending through the housing below the floor pedestal 37, and the body 21 is cast with the web 21′ thickened accordingly to include a cast supply duct or permit one to be drilled as a later operation. The provision of such supply duct and upstanding pedestal portion that comprises the base of the axle causes any oil flow across the floor towards the drainage duct divide and flow around it, so that it is convenient to dispose the vent passage 60 in the lee of this 'flow-divider', thereby deterring flow of oil into the vent passage as it descends to the lower part of the floor. However, it will be appreciated that should any small quantities of oil pass into the separation chamber by way of the vent passage they would be returned to the sump by way of the breather drainage duct 28.

It will be appreciated that the supply duct 70 represents an additional duct not normally associated with a breather assembly. The supply duct may terminate in an exposed wall of the breather assembly (not shown) for connection by pipe or hose to a suitable high pressure oil point on the engine or its standard filtration systems, or the supply duct may extend through the body to the mounting surface 22 of the crankcase and into operating alignment with a high pressure supply port provided for this purpose (not shown).

The breather assembly body 21 may contain ducts or have faces prepared to accept other components associated with cleaning lubricating oil supplied from the engine, such as a full flow oil filter, indicated ghosted at 80, or associated pressure relief valve 81.

Although the invention has been described with separate ducts for draining the separation chamber and centrifugal chamber, it will

be appreciated that the ducts within th housing 21 may merge into a common drainage duct before or at the fac 22.

It will be appreciated that the structural details of the centrifugal separator are open to variations as is common in the art. For instance, the cover part of the housing may be secured by way of a nut threaded onto the upper end of the axle, or the axle itself may be a spindle that is fixed to, and rotatable with the separation rotor.

CLAIMS

1. An engine crankcase breather assembly including a body having a mounting surface arranged to be mounted to a prepared face of a crankcase of an engine with which used, said body including an atmosphere inlet duct in said mounting surface arranged to be in communication with the atmosphere above an sump of the crankcase, an atmosphere outlet duct arranged to be connected to a combustion air intake of the engine and therewith to draw the crankcase atmosphere through the housing, a separation chamber between said atmospheric inlet and outlet ducts arranged to separate oil droplets from said atmosphere within the housing, a breather drainage duct extending between said separation chamber and mounting surface arranged to be in communication with a corresponding duct in the crankcase in communication with said oil sump,
and integrally with the assembly, a centrifugal cleaner for oil circulated within the engine from said crankcase sump.

2. An engine crankcase breather assembly as claimed in claim 1 in which said body defines wall and floor regions of an enclosure for a self-powered centrifugal separation rotor and a centrifuge drainage duct, extending through the body from said floor region to the chamber drainage duct.

3. An engine crankcase breather assembly as claimed in claim 2 including a vent passage extending through the body between the breather separation chamber and said centrifugal cleaner enclosure region.

4. An engine crankcase breather assembly as claimed in claim 3 in which the body is arranged to define the floor region, of the chamber such that it is stepped leading to said centrifuge drainage duct and the vent passage opens into the enclosure at a riser of the stepped floor region.

5. An engine crankcase breather assembly as claimed in any one of claims 1 to 4 in which said body includes an oil supply duct extending between a supply opening arranged to receive circulated lubrication oil at elevated pressure from said engine and a self-powered centrifugal separation rotor of the centrifugal cleaner within said enclosure defined by said wall and floor regions.

6. An engine crankcase breather assembly as claimed in claim 5 in which said supply opening is in said mounting surface of the body.

7. An engine crankcase breather assembly substantially as herein described with reference to the accompanying drawing.

The Patent Office

IL

Application No: GB 9619208.3 **Examiner:** John Twin
Claims searched: 1 to 7 **Date of search:** 26 November 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F1B

Int Cl (Ed.6): F01M 11/03, 13/00, 13/02, 13/04

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
	None	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.